INVESTIGATOR'S ANNUAL REPORT

National Park Service

All or some of the information provided may be available to the public

Reporting Year: 1996	**Park:** Shenandoah NP
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Permit#:
 SHEN1996ARWJ

Park-assigned Study Id. #:
unknown

Project Title:
 Dating Of Ground Water In Shenandoah National Park (N-203)

Permit Start Date: Jan 01, 1996	**Permit Expiration Date** Jan 01, 1998
Study Start Date: Jan 01, 1995	**Study End Date** Jan 01, 1998

Study Status:
 Completed

Activity Type:
 Research

Subject/Discipline:
 Water / Hydrology

Objectives:

 Determine age of ground water in Shenandoah National Park. Relate ground-water age to local hydrogeology and water-quality parameters. Determine ground-water age and water quality parameters under high and low flow conditions. Ground-water age is the time elapsed since precipitation entered the water table and was isolated from air.

Findings and Status:

 During the period 4/1/96 through 4/26/96, 34 springs and 17 wells located in the higher elevations throughout Shenandoah National Park were sampled for (1) major and minor element chemistry, (2) stable isotopes-- delta D, delta O-18 of water, delta S-34 of dissolved sulfate, and delta N-15 of nitrate, (3) age-dating-- CFC-11, CFC-12, CFC-113, tritium, and helium-3, and (4) dissolved gases-- nitrogen and argon for determination of recharge temperature of excess air. Based on CFC data, the average age of water from springs is 2.5 +/- 2.5 (1 sigma) years. Water from wells, with depths of 200 to more than 500 feet, averages 9.5 +/- 8.2 (1 sigma) years. Water from springs range in age from 0 to 8 years, while water from wells ranges from 0 to 22 years. A spring at the base of the Blue Ridge Mountains near Elkton has water that is approximately 33 years old. The recharge temperatures (water temperature at time of recharge) are similar for water from wells and springs and average 8.4 +/- 2.0 degrees C (1 sigma), with a range of 4.2 to 16.7 degrees C. Excess air (air trapped during recharge and dissolved in water) averages 0.5 cc/l for springs and 4.3 cc/l for water from wells. All waters are nearly free of VOCs and other halocarbons associated with urban or industrial activities. Tritium data are consistent with the young water ages, averaging 9.8 +/- 1.3 TU (1 sigma) for the spring water and 12.3 +/- 2.6 TU (1 sigma) for well water. The stable isotopic composition of the water plots parallel to the global meteoric water line with a deuterium excess of about 16.8 per mil with an average delta D of -49.6 per mil and delta O-18 of - 8.3 per mil (VSMOW scale). We are currently studying the water chemistry in relation to water-rock reactions, anthropogenic inputs and age. Further age information is expected soon based on tritium/helium-3 dating. Data on the stable isotopic composition of sulfate and nitrate are being studied. Other samples collected include air from the Air Monitoring Station at Big Meadows which is being analyzed for CFCs and sulfur hexafluoride. During April, 1996, 28 streams were sampled for stable isotopes and tritium along the base of the Blue Ridge Mountains below Shenandoah National Park. Evaluation of the data continues. The sampling will be repeated once low-flow conditions are reached in the Park, possibly in the late summer or early fall of 1997.

For this study, were one or more specimens collected and removed from the park but not destroyed during analyses?

No

Funding provided this reporting year by NPS:	Funding provided this reporting year by other sources:
0	58000

Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college	
Full name of college or university:	**Annual funding provided by NPS to university or college this reporting year:**
n/a	0